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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of Hermann Brüggendick et al

Ser.No.: 09/856,342

Filed: May 18, 2001

For: METHOD OF BURNING A NITROGEN-CONTAINING FUEL

Assistant Commissioner for Patents
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT

In accordance with 37 CFR § 1.56, Applicant wishes to call the attention of the Examiner to the following references:

1) US 4,023,921
2) EP 0 430 376 A2
3) FR 2 484 277
4) WO 91/10864
5) DE 33 31 989
6) Kolar J., Seiten, Pages 121-124

References 1 and 2 are in the English language and therefore do not need any discussion as to their relevance.

References 3 and 4 are cited in the International Search Report and are submitted to provide the Examiner easy access to said references.

Reference 5 discloses a method of reducing the NOx-emissions during combustion of nitrogen-containing fuels via burner units each including a primary burner and being

arranged in a wall of a closed combustion chamber; fuel and air for combustion are supplied to the burner flame in stages as partial flows via delivery means which are separate from one another. With a number of primary burners being arranged one above the other the method is carried out in three steps: feeding coal dust along with its carrier gas to the primary burner and generating a primary flame zone having a strong internal back flow region and burning the coal dust under fuel-rich conditions, feeding reduction fuel into the combustion chamber and generating a secondary flame zone in the vicinity of the primary flame zone and being operated under more-fuel-rich conditions than the primary flame zone, feeding reduction fuel into the combustion chamber and generating a secondary flame zone in the vicinity of the primary flame zone and being operated under more-fuel-rich conditions than the primary flame zone, and feeding state air into the combustion chamber of the secondary flame zone and being operated under fuel lean conditions.

Reference 6 discloses **Illustration 5.5.** The stage-mixture burner (SM-) as an example for the use of the air stages (air staggering) on a single burner (2).

The reactor is made of two states, as can be recognized from the right side of the illustration. Upon a constant combustion temperature of 1,350° C and a constant total air factor (or coefficient) of 1.17 at the end of the second part, the air ratio in the first part was varied. With an air coefficient λ_1 of 0.3, a maximum of NO_x formation occurs, with $\lambda_1 \approx 0.6$, a minimum of NO_x formation occurs. Measuring at a large-scale plant, likewise, yielded an increased NO_x formation with the primary air ration λ_1 from 0.65.

The staggered air supply can be practically workable with a single burner, a burner group, and in a firing chamber. Illustration 5.5 shows the air stages to a single burner. With a plurality of burner levels, the following process are possible:

- BOOS – "Burners-out-of-Service"

The lower burner levels are operated with slight deficiency of air, the upper or the topmost levels, in contrast, are only impacted with the air. This simple process is suitable for old systems, in which the output loss is calculated between 10-15% [11].

- BBF – "Biased-Burner-Firing"

The lower burners work in an area of air deficiency (fuel rich), the upper burners with air surplus. The output loss is therefore avoided for the most part, the NO_x-reduction is overall less [11].

For air staggering or staging in a firing chamber, one can calculate the injection from the wall air upon tangential firing [4]. The Over-Fire-Air (OFA) is very efficient. All of the burner levels work in the area of air deficiency; above the last level, an over-firing of combustion air take place by means of so-called over fire air ports. The process is useable for all fuels and all firing systems. Its efficiency is very much dependent on the realizable air coefficient (factor) in the burner. Depending on the fuel, the upper air supply averages 5-10% of the secondary air. Therefore, the following NO_x reductions are possible [12]:

Natural gas	10 – 30%
Fuel oil	10 – 40%
Hard coal, dry firing	10 – 40%
Hard coal, furnace firing	10 – 35 %

5.2.2.3 Air staggering (stages) with combustion engines

With diesel engines, the staggered air supply has been operatable for a long time as a (two-) chamber process (front and turbulence chamber process).

The principle of air staggering is designated by Otto-Motors as a layer concept ("Schichtladekonzept"). The primary energy conversion is included in the area of the ignition plug with a richly ignitable mixture (λ=0.6 – 0.9). The existing heat must guarantee the

reliable ignition and combustion of the lean mixture in the second stage. As examples, the following can be named: MAN-FM –(FM = "Fremdzundung-Mittelkugelbrennraum", or externally ignited intermediate sphere combustion chamber), VW-PCI-Texaco-, Nilov- and Honda-CVCC (Compound Vortex Controlled Combustion) processes. Primarily because of their higher production costs and fuel use, these layered engines have not prevailed [13-15].

Copies of the listed documents are submitted herewith along with the form PTO-1449.

It is respectfully requested that any fees required and not enclosed herewith or any shortages in any fees be charged to Deposit Account 02-1653.

Consideration of the foregoing in relation to this application is respectfully requested.

Respectfully submitted,

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Enclosures

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Complete if Known	
	Application Number	09/856,342
	Filing Date	May 18, 2001
	First Named Inventor	Hermann Brüggendick et al
	Group Art Unit	
	Examiner Name	
	Attorney Docket No.	AZ.2673

U. S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Patent Number	Issue Date	Patentee	Class	Subclass	Filing Date
JM	1	4,023,921	5/17/1977	Anson	431	9	11/24/1975

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation Yes	Translation No
JM	2	EP 0430376A2	05 Jun 1991	Europe	—	—	X	
JM	3	FR 2 484 277	18 Dec 1981	France	—	—		X
JM	4	WO 91/10864	25 Jul 1991	WIPO	—	—	X	
JM	5	DE 3331989	13 Dec 1988	Germany	—	—	X	

OTHER PRIOR ART B NON PATENT LITERATURE DOCUMENTS

Examiner Initials	Cite No.	
JM	6	Kolar, J., Seiten, Pages 121-124

Examiner		Date	6/2/03